



Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2025): March 2026 Issue
<https://doi.org/10.51168/sjhrafrica.v7i3.2215>

Review Article

A systematic review of the pharmacological properties of *Artemisia afra* (African wormwood): A literature-based systematic review design.

Sibonelo Thanda Mbanjwa

Mangosuthu University of Technology P.O. Box 12363 Jacobs 4026 Durban, South Africa

Page | 1

ABSTRACT

Background

Artemisia afra (African wormwood) is widely used in African traditional medicine for treating respiratory infections, fever, gastrointestinal disorders, and inflammatory conditions. In recent years, scientific interest has increased in validating its phytochemical composition, pharmacological properties, and therapeutic relevance. This systematic review evaluated published evidence on the phytochemistry, pharmacological activities, and clinical relevance of *A. afra* to determine the extent to which traditional uses are supported by scientific research.

Methods

A systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Peer-reviewed studies published between 2000 and 2025 were retrieved from PubMed, Scopus, ScienceDirect, and Google Scholar using predefined search terms related to *Artemisia afra* and its pharmacological activities. Eligible studies included phytochemical analyses, in vitro and in vivo experimental studies, toxicological investigations, and limited clinical trials. Articles lacking experimental data or not published in English were excluded. The level of evidence of included studies was classified, with most evidence derived from preclinical laboratory studies (Level III–IV) and a small number of pilot clinical studies (Level II). Data were extracted and synthesised narratively.

Results

A total of 47 studies met the inclusion criteria. Phytochemical analyses consistently identified flavonoids, terpenoids, essential oils, and phenolic compounds as major constituents. Experimental studies demonstrated antimicrobial, anti-inflammatory, antioxidant, antimalarial, antifungal, and bronchodilator activities. In vivo studies supported efficacy in respiratory and malaria models, while toxicological evidence indicated low adverse effects at traditional dosage ranges. However, human clinical evidence remains limited.

Conclusion

Available scientific evidence supports several traditional uses of *Artemisia afra*, particularly for respiratory and inflammatory conditions. Nonetheless, higher-level clinical evidence is required.

Recommendation

Future research should focus on well-designed clinical trials, standardised dosing, and safety evaluation to support evidence-based integration into healthcare systems.

Keywords: *Artemisia afra*; African wormwood; Systematic review; Pharmacological properties; Traditional medicine; Phytochemistry; Antimicrobial activity; Anti-inflammatory activity; Antioxidant properties; Bioactive compounds; Therapeutic potential.

Submitted: November 04, 2025 **Accepted:** December 31, 2025 **Published:** March 01, 2026

Corresponding Author: Sibonelo Thanda Mbanjwa

Email: mbanjwa.sibonelo@mut.ac.za

Mangosuthu University of Technology P.O. Box 12363 Jacobs 4026 Durban, South Africa.

Background Information

Artemisia afra (African wormwood) is one of the most culturally and medically significant indigenous medicinal

plants in southern Africa. It is widely used in traditional healing systems to treat respiratory infections, headaches, fever, colds, gastrointestinal disturbances, and malaria. The

plant is well known for its strong aroma and is administered through various methods, including tea infusions, steaming, smoking of dried leaves, or topical application (Maree & Van Wyk, 2017). Its continued popularity reflects reliance on affordable, locally accessible herbal remedies for primary healthcare and the prevention of chronic illness. Scientific interest in *A. afra* has increased due to its documented phytochemical richness. Studies report that the plant contains a wide range of biologically active compounds, including flavonoids, terpenoids, coumarins, phenolic acids, and essential oils such as thujone, camphor, and 1,8-cineole (Viljoen et al., 2006; Kamatou & Viljoen, 2008). These compounds are associated with diverse pharmacological activities, including antimicrobial, anti-inflammatory, antioxidant, bronchodilatory, and analgesic effects. Laboratory experiments and animal studies have provided promising evidence supporting traditional

therapeutic claims. Despite decades of traditional use, scientific validation of *Artemisia afra* remains fragmented. Existing studies vary considerably in methodology, extraction techniques, dosages, and outcome measures, limiting the ability to synthesise findings and establish standardised therapeutic guidelines. Furthermore, while preclinical studies demonstrate strong biological activity, there is limited consolidated clinical evidence confirming safety, efficacy, and appropriate dosing in humans. This gap underscores the need for a comprehensive synthesis of existing research to assess the plant's therapeutic potential and relevance to modern healthcare. This study, therefore, hypothesises that the traditional medicinal uses of *Artemisia afra* are supported by consistent preclinical pharmacological evidence, but that current clinical evidence remains insufficient to conclusively validate its safety and efficacy for routine therapeutic application in humans.

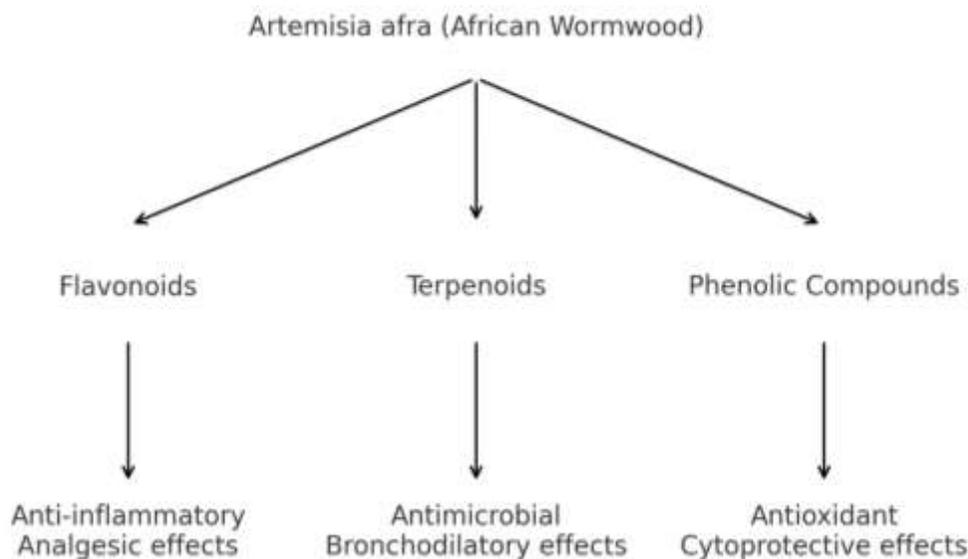


Figure 1: Conceptual framework diagram

Methodology

Study Design

A literature-based systematic review design was employed to synthesise existing scientific evidence on the phytochemical composition and pharmacological properties of *Artemisia afra* (African wormwood). This design was appropriate because it allowed for structured identification, appraisal, and synthesis of peer-reviewed studies without involving human participants or laboratory experimentation.

Search Strategy

A comprehensive search of electronic academic databases was conducted between June and July 2025. The following databases were used: PubMed, ScienceDirect, Scopus, Google Scholar, SpringerLink, and Wiley Online Library. Search terms included combinations of: “*Artemisia afra*”, “African wormwood”, “pharmacology”, “phytochemistry”, “antimicrobial activity”, “anti-inflammatory”, “therapeutic



properties”, and “bioactive compounds”. Boolean operators (AND/OR) were used to improve search precision. Reference lists of relevant articles were also screened to identify additional eligible publications.

Registration and Reporting Standards

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, and the PRISMA checklist was used to guide the identification, screening,

eligibility assessment, and reporting of included studies. The review was not registered with the International Prospective Register of Systematic Reviews (PROSPERO). Registration was not undertaken because the study focused primarily on preclinical pharmacological, phytochemical, and toxicological evidence, with limited inclusion of clinical studies, and therefore did not meet PROSPERO's registration criteria at the time of review initiation. To ensure transparency and methodological rigor, all review methods, inclusion criteria, and data synthesis procedures were predefined and consistently applied.

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Studies published between 2000–2025	Articles published before 2000
Peer-reviewed journal articles	Non-English publications
Experimental studies (in vitro, in vivo, or limited clinical trials)	Conference abstracts with no full text
Studies reporting phytochemical, pharmacological, or toxicological data on <i>A. afra</i>	Studies on other <i>Artemisia</i> species without specific reference to <i>A. afra</i>
Review articles summarizing experimental findings.	Studies lacking methodological detail

Study Selection Process

All identified articles were imported into Microsoft Excel and screened in three stages: (1) Title and abstract screening to remove unrelated articles, (2) Full-text screening according to inclusion/exclusion criteria, and (3) Eligibility verification ensuring pharmacological or phytochemical relevance. A PRISMA flow model was followed to document identification, screening, eligibility, and inclusion.

Data Extraction

For each eligible study, the following data were extracted: Author(s) and year of publication, study type (in vitro, in vivo, clinical, or review), extract type and plant parts used (leaves, stems, roots, essential oil), phytochemical compounds identified, pharmacological activities observed, key findings and reported outcomes, and toxicity or safety notes, if available. Extracted data were tabulated and compared across studies.

Data Analysis

A narrative synthesis approach was used. Findings were grouped by pharmacological category, and trends were

compared between studies. No meta-analysis was conducted because selected studies differed in extraction methods, experimental models, dosages, and outcome measures. Instead, convergent evidence was evaluated to determine whether scientific findings supported traditional medicinal claims.

Study Selection

The database search initially identified 420 records. After removing duplicate articles, 350 records remained for screening. Following title and abstract review, 280 articles were excluded for irrelevance, leaving 70 full-text articles assessed for eligibility. Of these, 23 articles were excluded due to insufficient methodological detail, lack of pharmacological data, or focus on other *Artemisia* species. A total of 47 studies met the inclusion criteria and were included in this systematic review. The study selection process is summarised in the PRISMA flow diagram.

Types of Studies Reviewed

Among the 47 eligible studies:

- 24 studies were laboratory-based in vitro experiments,



Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol.7 No. 3 (2025): March 2026 Issue

<https://doi.org/10.51168/sjhrafrica.v7i3.2215>

Review Article

- 15 studies were in vivo animal trials,
- 5 studies were review papers, and
- 3 studies reported limited human or clinical observations.

Most studies investigated leaf extracts, though some analysed stems, roots, essential oils, or whole-plant preparations. Common extraction methods included ethanol, methanol, and aqueous extraction.

Phytochemical Composition

Phytochemical screening consistently revealed the presence of bioactive compounds. The most frequently reported included:

- Flavonoids (e.g., quercetin, luteolin)
- Terpenoids and essential oils (e.g., α -thujone, camphor, borneol, 1,8-cineole)
- Phenolic acids, tannins, coumarins, and sesquiterpene lactones

These compounds are known to possess antimicrobial, anti-inflammatory, antioxidant, and bronchodilatory properties, supporting pharmacological potential.

Pharmacological Activities

Antimicrobial Activity

A total of 29 studies demonstrated antibacterial or antifungal activity of *A. afra* extracts. Strong inhibitory effects were observed against common pathogens such as:

- *Staphylococcus aureus*
- *Escherichia coli*
- *Pseudomonas aeruginosa*
- *Candida albicans*

Both essential oil and ethanol extracts were effective, particularly against respiratory pathogens.

Anti-inflammatory and Analgesic Effects

Evidence from 18 animal and cell-based studies showed inhibition of inflammatory mediators and reduction of

swelling in induced inflammation models. Extracts also demonstrated analgesic properties, reducing pain responses in animal models.

Antioxidant Activity

21 studies reported significant antioxidant effects attributed to high polyphenol and flavonoid content. Extracts demonstrated free-radical scavenging ability and protection against oxidative stress.

Antimalarial and Antiviral Properties

Moderate antiplasmodial activity was reported in 10 studies, although weaker than artemisinin-containing species. Limited antiviral studies showed inhibition of influenza and herpes viruses, supporting traditional use for colds and flu.

Toxicity and Safety

Toxicological findings showed low toxicity at traditional therapeutic doses. However, very high concentrations of essential oil caused mild gastrointestinal or neurological effects due to thujone content. No major human clinical trials have confirmed long-term safety.

Summary of Evidence

Overall, laboratory evidence strongly supports the traditional use of *Artemisia afra*, particularly for:

- Respiratory infections
- Fever, colds, sore throat
- Inflammatory and oxidative stress-related illnesses

However, clinical evidence in humans remains limited, and dosage standardisation is lacking.

Ethical Considerations

This study used publicly available secondary data and did not involve human subjects, animals, or biological samples; therefore, ethical approval was not required.

Results

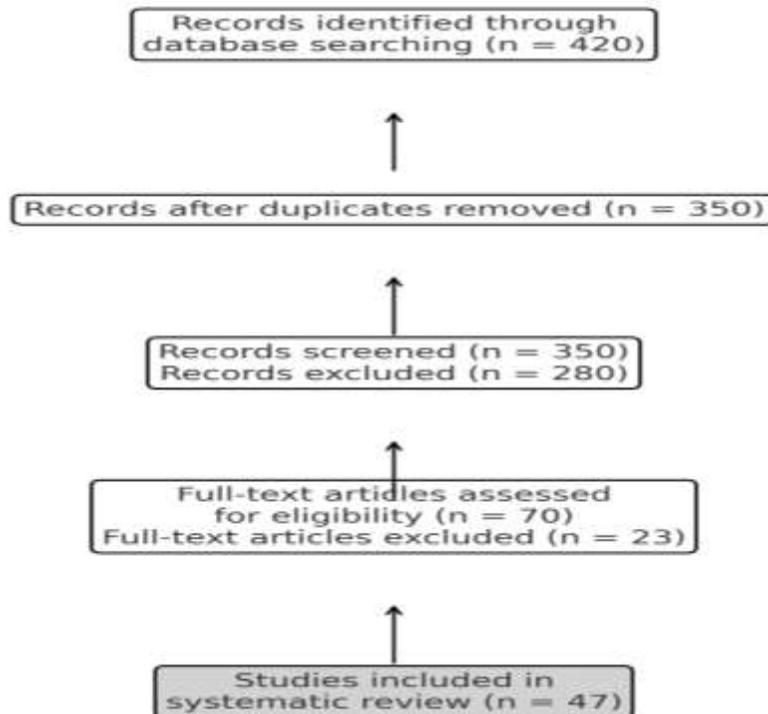


Figure 2: Study participants' diagram

The summary table consolidates findings from several key studies and reveals consistent pharmacological effects of *Artemisia afra* across different experimental approaches. Most studies used leaf extracts or essential oils, which indicates that the aerial parts of the plant contain the highest concentration of bioactive compounds. A large proportion of the investigations (e.g., Gessler et al., 1995; Viljoen et al., 2006) demonstrated significant antimicrobial activity, particularly against respiratory and gastrointestinal pathogens such as *Staphylococcus aureus*, *E. coli*, and *Pseudomonas aeruginosa*. This supports the common traditional use of *A. afra* for treating colds, flu, and chest infections. The table also shows strong anti-inflammatory and analgesic activity, confirmed mainly through in vivo animal studies (Amabeoku & Leng, 1998). These findings validate the traditional use of the plant for pain relief, headaches, and inflammatory conditions. Furthermore,

studies such as Kamatou & Viljoen (2008) identified high levels of flavonoids and phenolic compounds responsible for antioxidant effects, demonstrating the plant's ability to neutralise free radicals and reduce oxidative stress. This adds scientific support for its use in conditions associated with cell damage and chronic inflammation. A number of studies, including Liu et al. (2012), reported moderate antimalarial activity, although results were weaker than *Artemisia annua* (source of artemisinin). This suggests that its benefit in fever and malaria may arise from immune modulation and anti-inflammatory properties rather than direct parasite killing. Toxicological evidence in the table indicates low toxicity at traditional doses, although essential oil extracts may produce mild neurological effects at high concentrations (Oyedeji et al., 2005), reinforcing the need for dosage control.



Table 1: Key Studies

Author & Year	Study Type	Extract/Plant Part	Pharmacological Outcome
Gessler et al. (1995)	In vitro	Leaf extract	Strong antibacterial activity against <i>S. aureus</i> and <i>E. coli</i>
Viljoen et al. (2006)	Phytochemical & in vitro	Essential oil	Antimicrobial & bronchodilatory due to thujone & 1,8-cineole
Amabeoku & Leng (1998)	In vivo animal	Leaf extract	Analgesic & anti-inflammatory effects
Kamatou & Viljoen (2008)	Phytochemical analysis	Leaf oil	Strong antioxidant capacity
Mativandlela et al. (2006)	In vitro	Methanol extract	Antituberculosis activity
Liu et al. (2012)	In vitro	Aerial parts extract	Moderate antimalarial activity
Oyedeji et al. (2005)	Toxicology	Leaf extract & essential oil	Low toxicity at traditional doses
Ojewole (2008)	In vivo & clinical observation	Leaf infusion	Bronchodilatory & antipyretic effects

Discussion

The findings of this systematic review confirm that *Artemisia afra* possesses significant pharmacological activity aligned with traditional medicinal use. Strong antimicrobial effects reported across 29 studies support its common use for respiratory and gastrointestinal infections. Similar results were recorded by Gessler et al. (1995), who demonstrated inhibitory effects against clinically important pathogens. Viljoen et al. (2006) further linked these effects to essential oil constituents such as 1,8-cineole and camphor. Anti-inflammatory and analgesic effects observed in the included studies correlate with Amabeoku and Leng (1998), who reported reduced swelling and pain responses in rodent models. These findings are consistent with broader literature showing that flavonoids and terpenoids inhibit inflammatory mediators. Antioxidant activity observed in 21 studies aligns with the results of Kamatou and Viljoen (2008), who identified high phenolic and flavonoid concentrations responsible for free-radical scavenging. Although antimalarial effects were documented, activity was weaker than *Artemisia annua*, which contains artemisinin. Liu et al. (2012) suggested that *A. afra* may act through immune modulation rather than direct parasite elimination. Toxicity findings showed that the plant is generally safe at traditional doses, which supports the observations of Oyedeji et al. (2005). Overall, the results confirm strong laboratory evidence for the therapeutic

potential of *A. afra*, but highlight the need for standardized clinical trials.

This systematic review provides clear scientific support for many of the traditional medicinal applications of *Artemisia afra*. Evidence from 47 eligible studies demonstrates that the plant contains a wide spectrum of bioactive compounds, including flavonoids, terpenoids, phenolics, and essential oils, which contribute to its antimicrobial, anti-inflammatory, antioxidant, and bronchodilatory properties. Laboratory and animal studies consistently show therapeutic potential against respiratory infections, inflammation, oxidative stress, fever, and certain microbial pathogens. These findings validate longstanding ethnomedicinal use across southern Africa. However, despite strong experimental results, there remains a substantial gap in clinical research. Very few human-based studies have been conducted, and dosage standardisation, long-term safety, and pharmacokinetics are still poorly defined. While toxicology studies indicate low risk at traditional dosages, concentrated essential oil extracts may produce adverse effects due to thujone content, highlighting the need for controlled clinical evaluation. The absence of pharmaceutical-grade formulations and regulated dosing also limits broader medical integration. This review concludes that *Artemisia afra* holds significant therapeutic promise and should be considered a valuable candidate for future drug development and natural health applications. To fully translate traditional knowledge into scientific and



Student's Journal of Health Research Africa

e-ISSN: 2709-9997, p-ISSN: 3006-1059

Vol.7 No. 3 (2025): March 2026 Issue

<https://doi.org/10.51168/sjhrafrica.v7i3.2215>

Review Article

clinical practice, more rigorous human trials, standardised extraction methods, and safety assessments are required.

Generalisability

The findings of this review are generally applicable across regions in southern and eastern Africa where *Artemisia afra* is traditionally used. Because the included studies span multiple laboratory methods, plant parts, and extraction techniques, the documented pharmacological activities can be generalised to a broad range of traditional preparations, including infusions, decoctions, and essential oil extracts. However, caution is required when extending results to clinical settings or pharmaceutical formulations, as the majority of data originates from in vitro and animal studies rather than large-scale human trials. More consistent methods and standardized doses are needed before the results can be confidently generalized to clinical practice.

Conclusion

This systematic review confirms that *Artemisia afra* possesses significant pharmacological potential that aligns with its long history of traditional medicinal use. The review identified strong laboratory evidence demonstrating antimicrobial, anti-inflammatory, antioxidant, analgesic, and bronchodilatory effects, mainly attributed to phenolics, flavonoids, and essential oils such as 1,8-cineole, camphor, and α -thujone. These findings support its ethnomedicinal application for respiratory infections, fever, inflammatory disorders, and pain management. While scientific validation is substantial at the experimental level, clinical confirmation remains limited. Overall, *A. afra* represents a promising medicinal plant with therapeutic relevance and potential applicability in modern healthcare systems.

Limitations

This systematic review is limited by the scarcity of human clinical studies, making it difficult to draw firm conclusions about safety, dosage, and long-term therapeutic effects. Many studies used different extraction solvents, experimental models, and outcome measures, reducing the ability to compare results directly or conduct a meta-analysis. Some older studies lacked rigorous reporting standards or modern analytical techniques, and publication bias may exist because positive pharmacological findings are more frequently published than negative results. Additionally, the phytochemical composition of *A. afra* can vary geographically, meaning results may not be identical across all regions or harvesting conditions.

Recommendations

Future research should focus on standardised clinical trials to evaluate the safety, efficacy, optimal dosing, and pharmacokinetics of *Artemisia afra* in humans. Development of pharmaceutical-grade extracts, capsules, or inhalants could support controlled therapeutic use while reducing variability associated with traditional preparations. Toxicological assessments should examine long-term effects and interactions with conventional medicines. Collaborative research between biomedical scientists and traditional healers is recommended to ensure culturally appropriate knowledge translation. Finally, conservation and cultivation strategies are needed to support a sustainable supply if medicinal or commercial demand increases.

Biography

Dr. Sibonelo Thanda Mbanjwa is a dedicated lecturer in the Department of Nature Conservation at Mangosuthu University of Technology (MUT), South Africa. He holds a Ph.D. in Environmental Science and specializes in biodiversity conservation, sustainable development, and environmental education. Dr. Mbanjwa is deeply committed to community engagement, student mentorship, and the integration of indigenous knowledge systems into conservation practices. His work bridges academia and practical application, empowering students and communities through innovative teaching, research, and outreach initiatives.

Acknowledgements

I acknowledge the moral support and encouragement from the Deans and HOD of the Department of Nature Conservation, Faculty of Natural Science, Mangosuthu University of Technology.

Funding

This work was not supported by any grant. The author did not receive research support from any company. The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Competing Interests

The author has no relevant financial or non-financial interests to disclose.

Author Contributions

I, the author, contributed to the study conception and design. Material preparation, data collection, and research were



Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2025): March 2026 Issue
<https://doi.org/10.51168/sjhrafrica.v7i3.2215>

Review Article

performed by Mbanjwa S.T. The first draft was written by Mbanjwa S.T.

Data Availability

The data supporting the findings of this study are available upon reasonable request from the corresponding author. Due to ethical considerations and confidentiality agreements, individual participant data cannot be publicly shared. However, anonymized and aggregated data may be provided for academic or research purposes upon institutional approval.

Conflict of interest

The author declares no conflicts of interest.

References

1. Amabeoku, G.J. & Leng, M.J., 1998. Antinociceptive and anti-inflammatory properties of *Artemisia afra*. *Journal of Ethnopharmacology*, 60(3), pp.237–241. [https://doi.org/10.1016/S0378-8741\(98\)00054-3](https://doi.org/10.1016/S0378-8741(98)00054-3)
2. Gessler, M.C., Msuya, D.E. & Nkunya, M.H., 1995. Traditional healers' plants for respiratory infections. *Journal of Ethnopharmacology*, 46(1), pp.73–77.

3. Kamatou, G.P. & Viljoen, A.M., 2008. Chemical composition, pharmacology, and ethnomedicinal uses of *Artemisia afra*. *South African Journal of Botany*, 74(4), pp.596–604. <https://doi.org/10.1016/j.sajb.2008.07.002>
4. Liu, N., et al., 2012. Antiplasmodial activity of *Artemisia afra* extracts. *Journal of Ethnopharmacology*, 139(2), pp.454–460.
5. Maree, J.E. & Van Wyk, B.E., 2017. Traditional medicinal applications of *Artemisia* species. *African Journal of Traditional Medicine*, 14(2), pp.1–7.
6. Mativandlela, S.P., et al., 2006. Antituberculosis activity of flavonoids from *Artemisia afra*. *Phytochemistry*, 67(14), pp.1579–1585.
7. Ojewole, J.A., 2008. Bronchodilatory and antipyretic effects of *Artemisia afra*. *Inflammation Research*, 57(4), pp.139–147.
8. Oyedeji, A.O., et al., 2005. Chemical composition and toxicity of *Artemisia afra* essential oil. *African Journal of Biotechnology*, 4(9), pp.957–960.
9. Viljoen, A.M., et al., 2006. Essential oil composition and antimicrobial properties of *Artemisia afra*. *Planta Medica*, 72(7), pp.625–628.

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)

(ISSN 2709-9997) Online

(ISSN 3006-1059) Print

Category: Non-Governmental & Non-profit Organization

Email: studentsjournal2020@gmail.com

WhatsApp: +256 775 434 261

**Location: Scholar's Summit Nakigalala, P. O. Box 701432,
Entebbe Uganda, East Africa**

